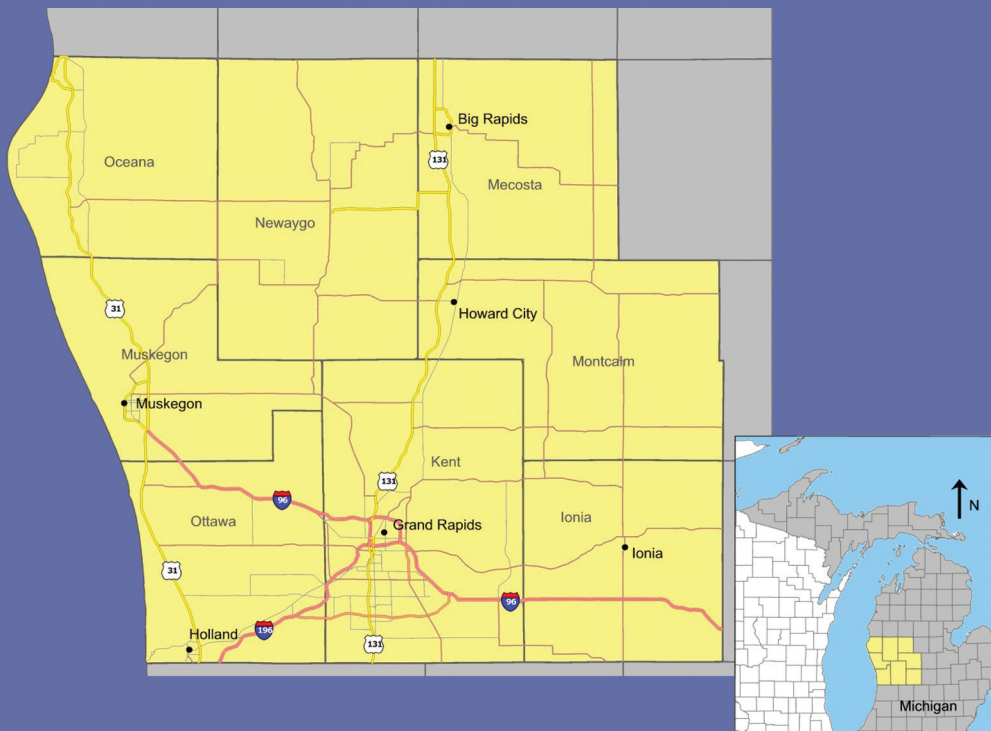


Grand Region ITS Telecommunications Study

SUMMARY



Michigan Department of Transportation
Grand Region Office

October 2008

INTRODUCTION



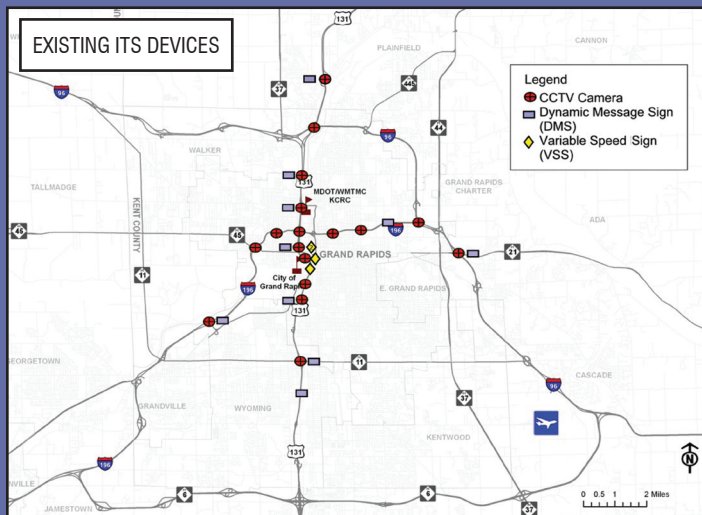
→The goal of the Grand Region ITS Telecommunications study is to effectively plan ITS communications network improvements that will facilitate sustained system growth to meet existing and near-term needs, as well as to develop a strategy for addressing long-term requirements of MDOT and its partner agencies.

EXISTING SYSTEM



→The MDOT telecommunications infrastructure is comprised of two types of physical infrastructure components: the Western Michigan Traffic Management Center (WMTMC) and Field Devices. There are direct communications links from the WMTMC to Field Devices, as well as center-to-center connectivity between WMTMC and the City of Grand Rapids TMC. The system consists of:

- 17 CCTV Cameras
- 10 Dynamic Message Signs (DMS)
- 4 Variable Speed Signs (VSS) and an Anti-Icing System
- 8 Frost Tube Locations in Muskegon, Newaygo, and Ottawa Counties (managed by TSCs)



FUTURE NEEDS



→**MDOT Requirements:** The following system enhancements should be considered in planning future system bandwidth requirements:

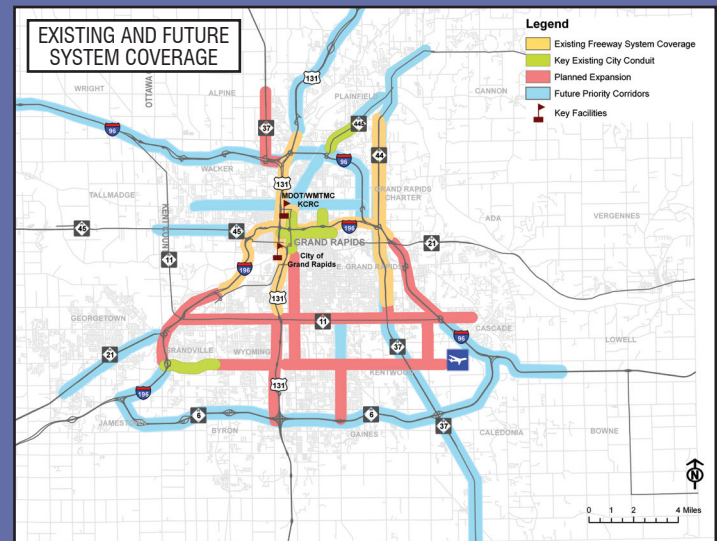
Trunkline Management System Expansion

To determine highest-case system load for communications, future expansions are assumed to include the following:

- CCTV Cameras - one per mile of freeway or trunkline
- Detector Stations - one per mile of freeways and at mid-block locations on priority arterials
- DMSs - one per mile of freeway or trunkline
- RWIS Stations - one to five per county

Signal System Integration

MDOT's regional trunkline signal systems, both existing and future, are assumed to be integrated into the Grand Region ITS network as a means of communication between local or master intersections and central software.



→**Partner Agency Requirements:** MDOT has a close partner relationship with the City of Grand Rapids. 350+ traffic signals belonging to the State, the City, and surrounding cities and counties are currently controlled and maintained via fiber and wireless interconnect from the City of Grand Rapids TMC. MDOT and the City currently share communications infrastructure; and both agencies have access to the other's data. It is important that future data needs continue to be provided through shared network resources and center-to-center communications between MDOT and the City.

ALTERNATIVES ANALYSIS



→Based on existing system characteristics and deficiencies, future system requirements, and a review of current communications technologies, three technically feasible alternatives for upgrade to the MDOT communication system were developed and evaluated.

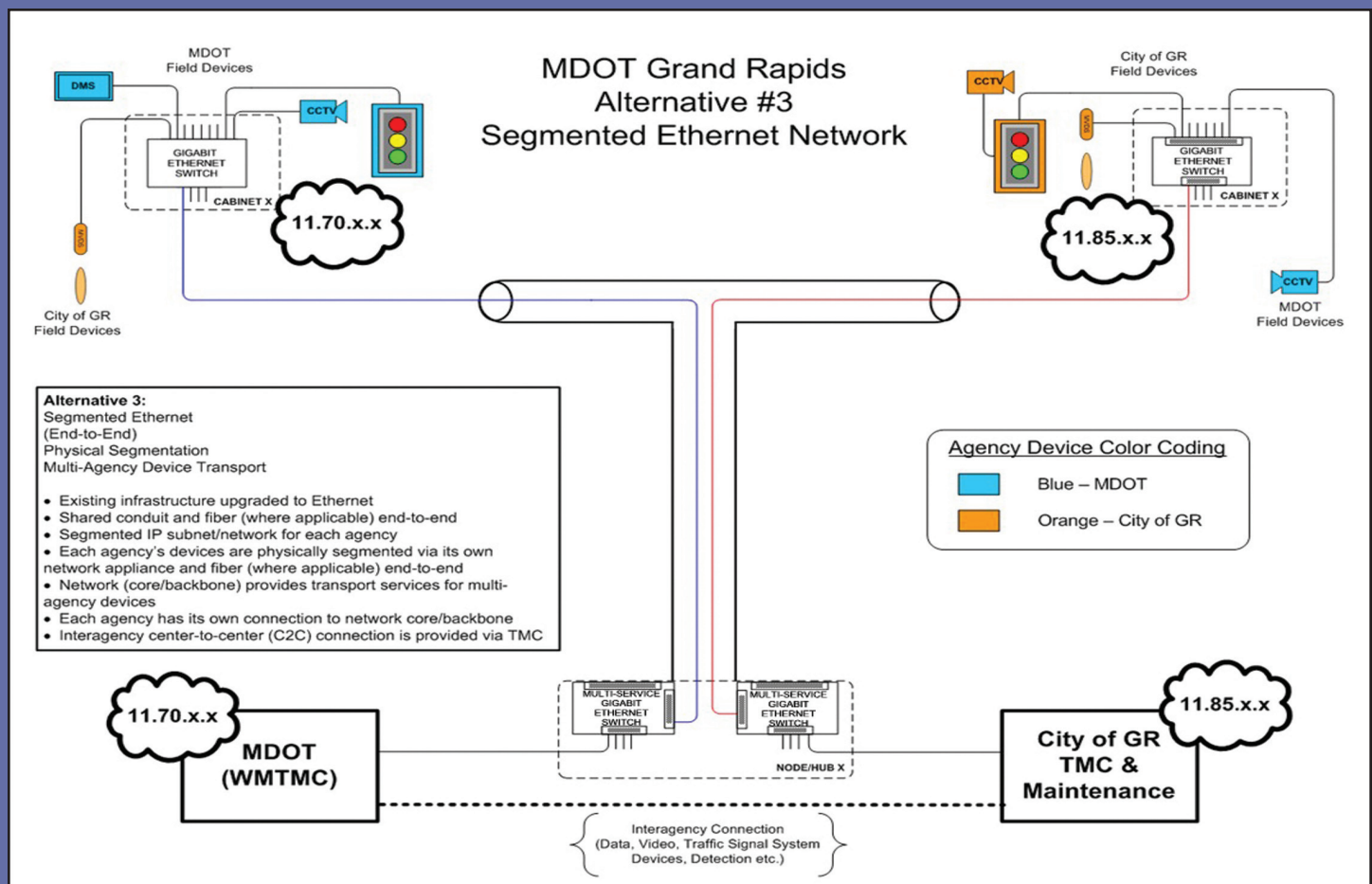
Each alternative was evaluated based on the following criteria:

- ability to address needs and requirements
- maintenance and operations
- security
- redundancy
- flexibility and expandability
- bandwidth management and efficiency

Alternative 3 was found to be the most advantageous for MDOT. It best meets the needs and requirements identified by MDOT and partner agencies while providing the most robust network obtainable.



ALTERNATIVE	DESCRIPTION AND FEATURES
Alternative 1 Shared Ethernet (End-to-End) No Segmentation	<ul style="list-style-type: none"> Existing infrastructure upgraded to Ethernet Shared end-to-end <ul style="list-style-type: none"> Conduit Fiber Network appliances Single IP subnet Each agency connected to network core/backbone Interagency center-to-center (C2C) connection is provided via network core/backbone
Alternative 2 Shared Ethernet (End-to-End) Virtual Segmentation	<ul style="list-style-type: none"> Existing infrastructure upgraded to Ethernet Shared end-to-end <ul style="list-style-type: none"> Conduit Fiber Network appliances Segmented IP subnet/network for each agency Each agency's devices are virtually segmented by subnet/VLAN at each network appliance Each agency has its own connection to network core/backbone Interagency center-to-center (C2C) connection is provided via network core/backbone or TMC
Alternative 3 Segmented Ethernet (End-to-End) Physical Segmentation	<ul style="list-style-type: none"> Existing infrastructure upgraded to Ethernet Shared end-to-end <ul style="list-style-type: none"> Conduit Fiber or buffer tube (where applicable) Segmented IP subnet/network for each agency Each agency's devices are physically segmented via its own network appliance and fiber (where applicable) end-to-end Network (core/backbone) provides transport services for multi-agency devices Each agency has its own connection to network core/backbone Interagency center-to-center (C2C) connection is provided via TMC



RECOMMENDATIONS

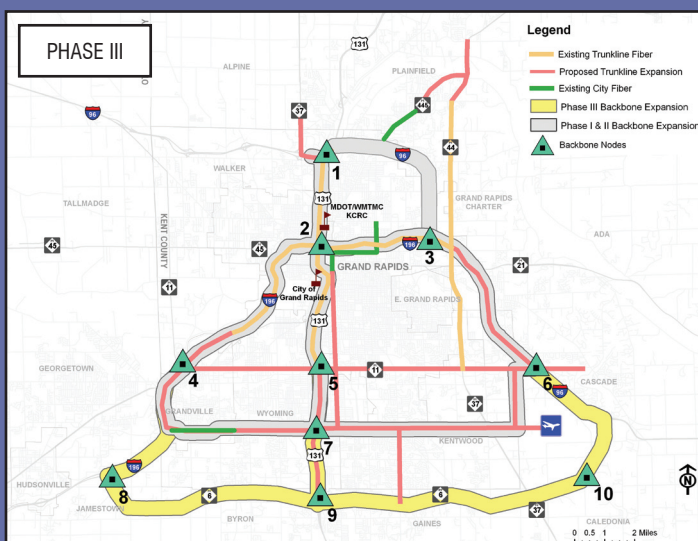
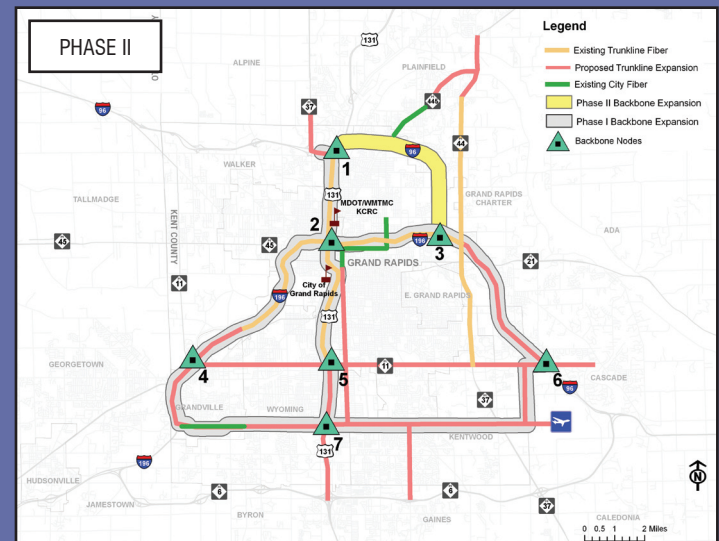
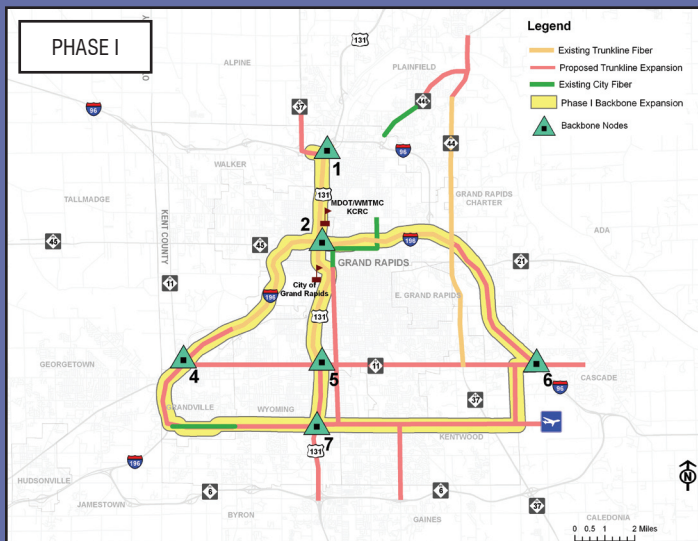


→The following is a summary of the recommendations aimed at implementing Alternative 3:

- Creation of a partial mesh Ethernet backbone with redundancy (Phase I)
- Phased migration of existing system(s) directly to the MDOT backbone
- Integration of existing field devices directly to nearby communication nodes using a combination of wired and wireless connections
- Introduction of new nodes as necessary to accommodate expansion/integration of devices along identified priority corridors (Phase I and Phase II)

- Introduction of new nodes or wireless communications towers as necessary to accommodate long-haul interconnections to other Regions

The City of Grand Rapids may share the proposed backbone location and general topology as a means of leveraging shared regional conduit infrastructure. However, based on the recommended network configuration, the City would operate a parallel backbone on dedicated fibers and using dedicated network appliances separate from the MDOT network.



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